Achieving Sustainable Networks - Operator's Perspective

Orange group

Azeddine GATI
26/06/2013

Orange Group

over 224 million customers worldwide…

> residential
operations
in 33 countries

> business
services
in 220 countries
and territories

United Kingdom
Poland
Belgium
Luxembourg Slovakia
Moldova
France
Romania
Spain
Portugal
Armenia
Irak
Tunisia
Morocco
Jordan
Egypt
Senegal
Mali
Niger
Guinea-Bissau
Guinea Conakry Ivory Coast
Central African Republic
Dominican Republic
Cameroon
Caribbean
Uganda Kenya
Democratic Republic
of Congo
Madagascar
Vanuatu
Mauritius
Botswana
Reunion Island

*since end of June 2012

in 2011

> our total ITN energy consumption : 4 TWh

> our CO_2 emissions : ~ 300,000 round trips Paris – New York by plane

Corporate Social Responsibility :

The way a company contributes to sustainable development while seeking a fair balance between competition, social progress, and protecting the environment

- Orange group have the ambition to reduce GHG emissions and Energy consumption by 20% in 2020 and +renewable energy +20% (EU commitment)

- CSR is being more and more considered by international rating organisms

- Make green as a service (green computing, cloud, M2M)

- Innovation as a differentiation enabler

- New regulation and taxes are expected before 2020

Our ambition : green by design infrastructure

objectives: Put green in our DNA

- Prepare the green transformation of our networks
- Make green as a service by developing green-by-design devices and services (M2M applications, cloud)
- off-grid countries
- out-of-the box ideas (architecture, hardware, …)

Constraints & opportunities

- The traffic is expected to increase x100 in the next decade which induce more infrastructure
- broadband everywhere and seamless connectivity
- Energy price is expected to increase : +60% rise forecasted in Europe in 2018 (vs. 2011)
- Hardware consumes energy even with zero traffic

Energy costs evolution
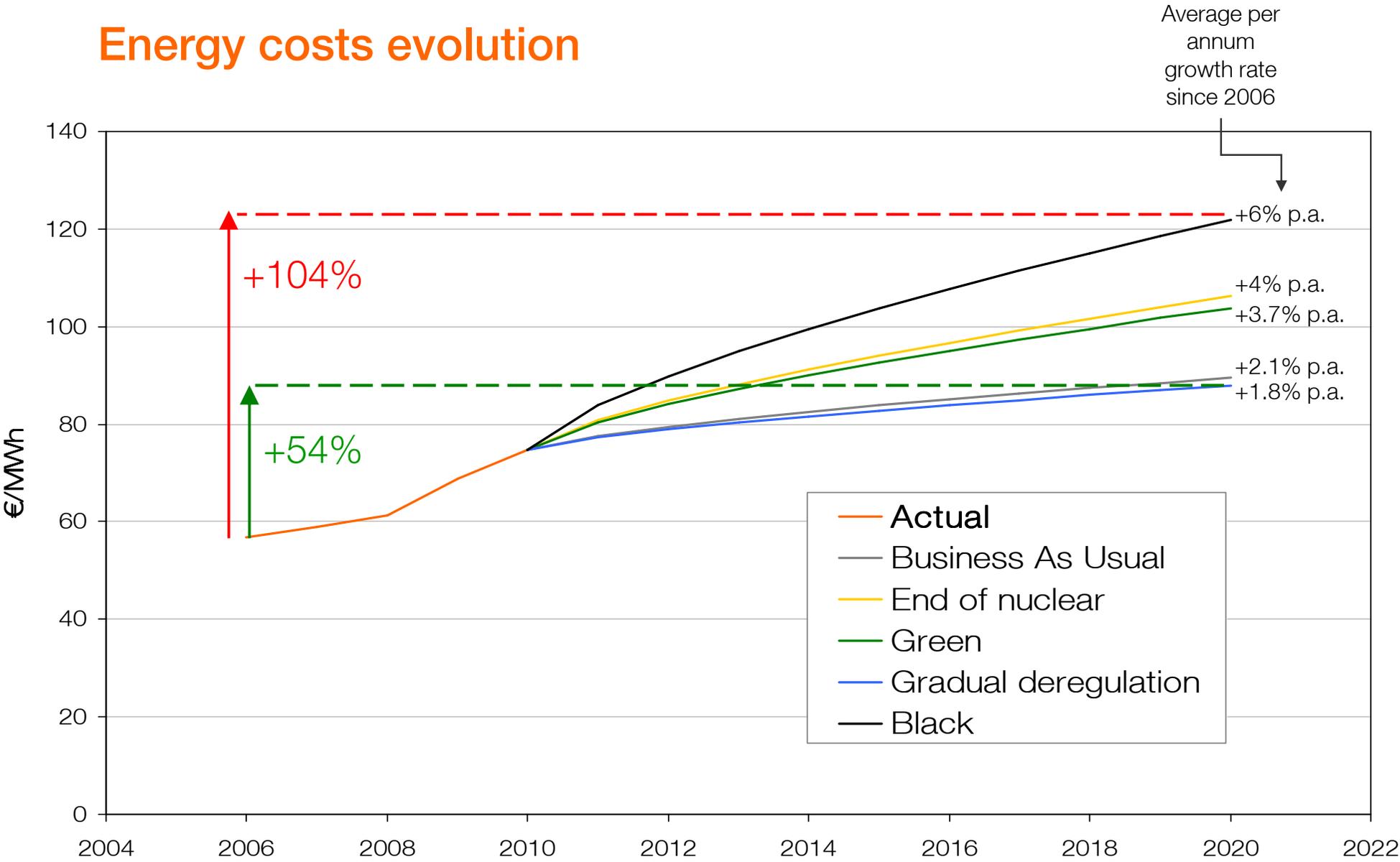
Carbone 4 projections: electricity unitary cost for Orange– example of France

Average per annum growth rate since 2006

+6% p.a.
+4% p.a.
+3.7% p.a.
+2.1% p.a.
+1.8% p.a.

+104%

+54%

€/MWh

Legend:
- Actual
- Business As Usual
- End of nuclear
- Green
- Gradual deregulation
- Black

A

what else …

- need for global and unified solution for monitoring networks consumption

site monitoring — electricity, fuel, temperature

equipment monitoring — consumption, usages, traffic

supervision — reporting, analysis, alarms…

- need for scalable and dynamic hardware : zero consumption at zero traffic
    - fast sleep modes, dormant mode

- move from technology centric networks to software defined networks
    - reconfigurable hardware

- move from always on to always available

- collaborative and open innovation : disruptive solutions (GreenTouch)

Many projects on greener ICT equipment, network or architecture → need of unified assessment method

- **Greentouch**: new network architectures for hig Energy Efficiency in W/bit/s

- **Trend**: dynamic management of transport network equipment to avoid explosion of consumption due to explosion of traffic

- **Econet**: Green Abstraction Layer (GAL): reduction by choosing optimal network paths through a minimum number of activated nodes

- **Opera-Net2:** high efficient radio emitter, standby mode management, less cooling and heating, hybrid solar energy

- **Odyssea:** pear to pear storage versus giga-datastorage ?

- COMBO : future converging networks and NGPoP

Fundamental questions

- reduce the consumption of IT is facing fundamental questions:

  - hardware energy efficiency (10% p.y) improvement does not compensate the rise of traffic (+60% p.y) and software → need new architecture, new development methods

- change the paradigm : move from "always-on" to "always available"

  - e.g. switch off non-used resources
  - use smart devices

- what type of networks : concentrated vs. distributed

  – Small and big data centers (CDN, ICN, caching, NGPoP...)
  – cloud / green computing

- how to manage the peak consumption

  – social acceptability to reduce the QoS
  – think telecom and energy

- optimize coexistence of multiple access technologies (2G, 3G, H+, LTE, Wifi, fixed)

  - need for seamless and multi-Radio-access optimization to avoid redundancy
  - SON, optical burst, MIMO, ...),

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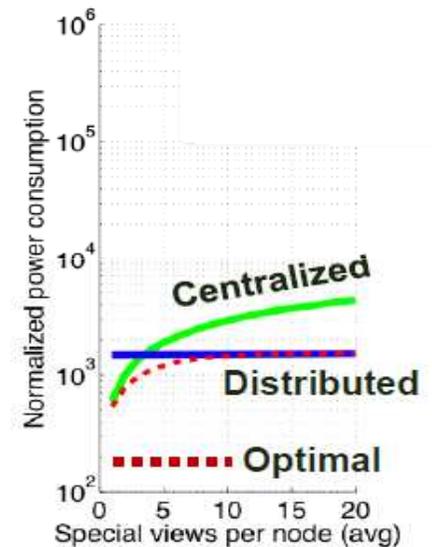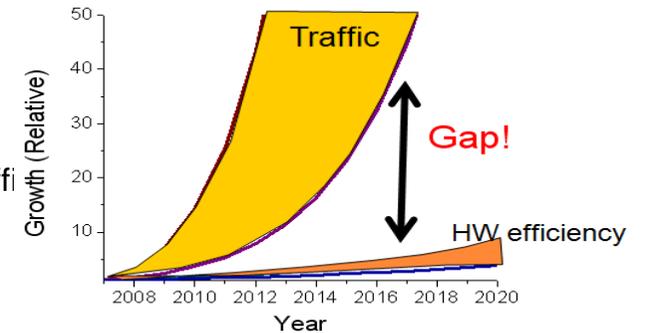
The green triumvirate

C. Shannon

$$C \leqslant W * \log(1 + P/N)$$

G. Moore

- the number of <u>transistors</u> on <u>integrated circuits</u> doubles approximately 18 months

Jonathan Koomey

- the energy efficiency of computers doubles roughly every 18 months

how to deal with traffic increase

- a factor of x1000 (kbps/w) has already been achieved : GSM-> LTE but in 20 years essentially driven by spectral efficiency

Cellular Tech. Evolution
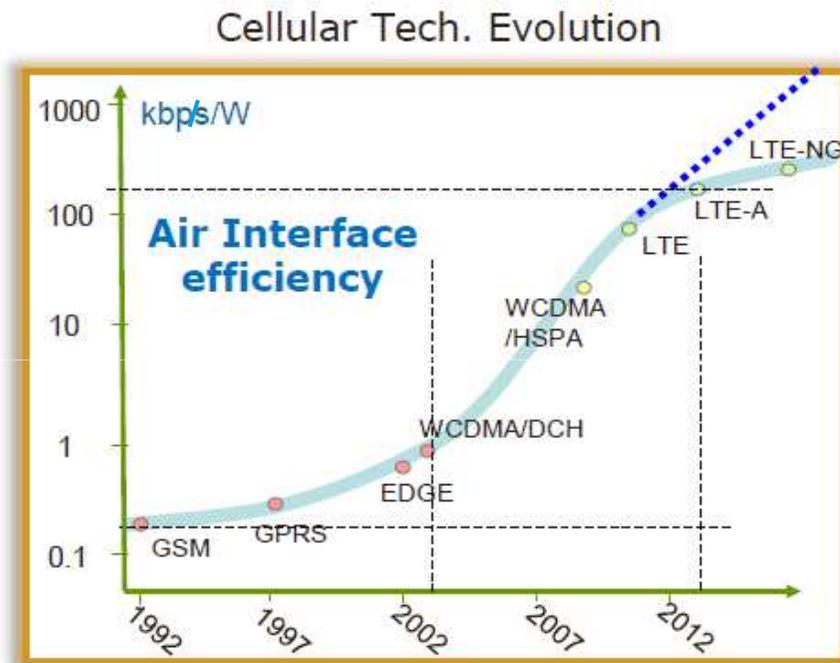
- GSM → LTE-A, 1000x, 20 years
- WCDMA -> LTE-A, 100x, 10 years
- LTE-A → LTE-NG, ~3x??, <5 years??
- Peak Efficiency is no longer enough to deal with the exponential traffic growth
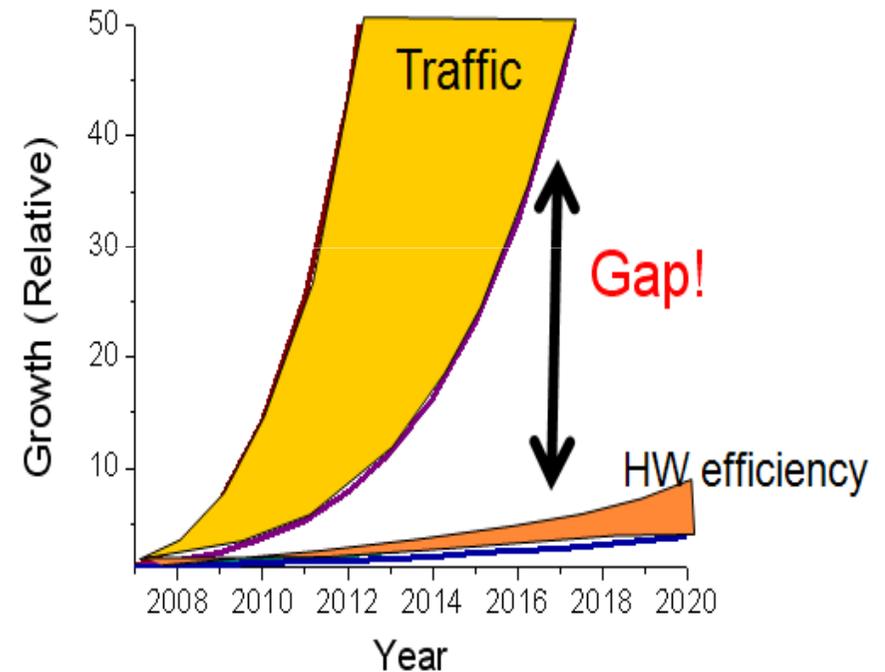
Traffic and network repartition : 70% of traffic is transported by 35% of the sites

Sites distribution - France

Dense Urban 11%
Urban 24%
Sub-Urban 27%
Rural 38%

65%
35%

Trafic distribution

Rural 14%
Dense Urban 37%
Sub Urban 16%
Urban 33%

30%
70%
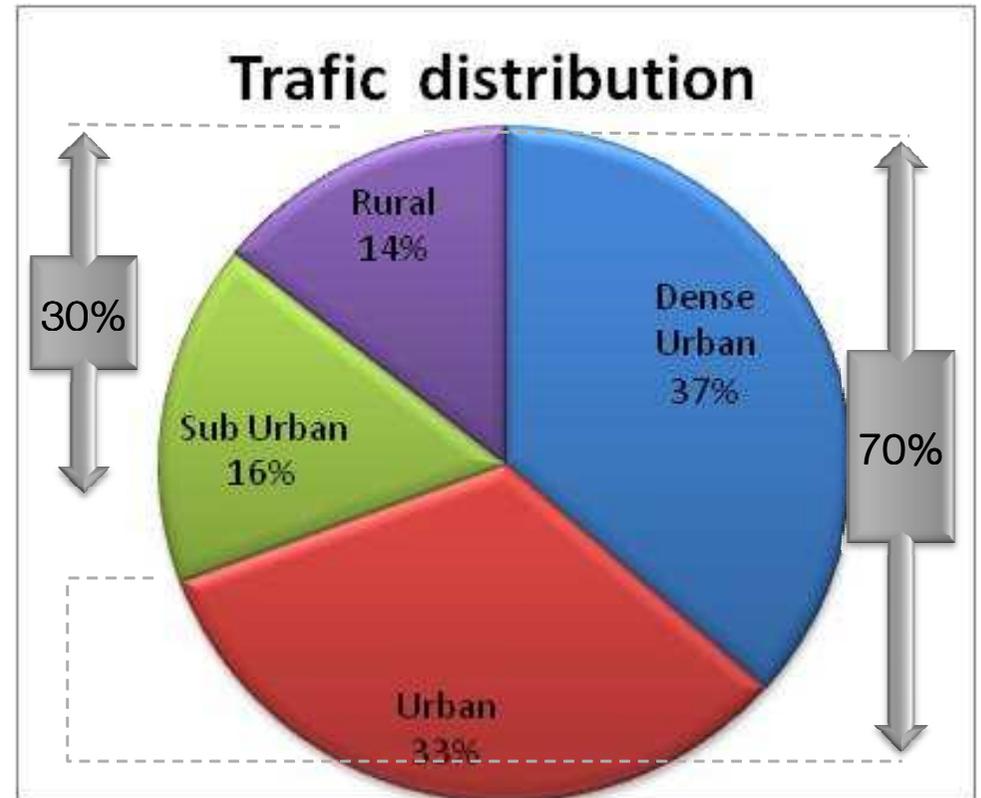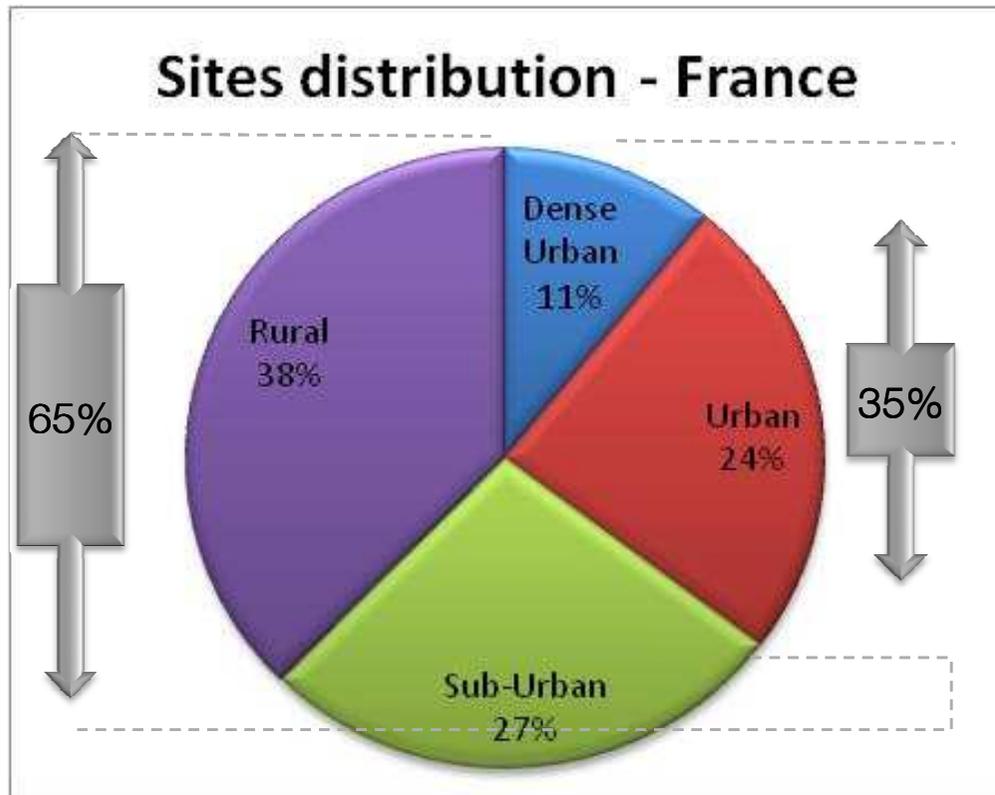
- Consumption (watt) is driven by Rural and sub-urban Areas
- Energy efficiency (bit/s/watt) is driven by Dense-urban and urban areas

Annual traffic projection

Traffic demand per site
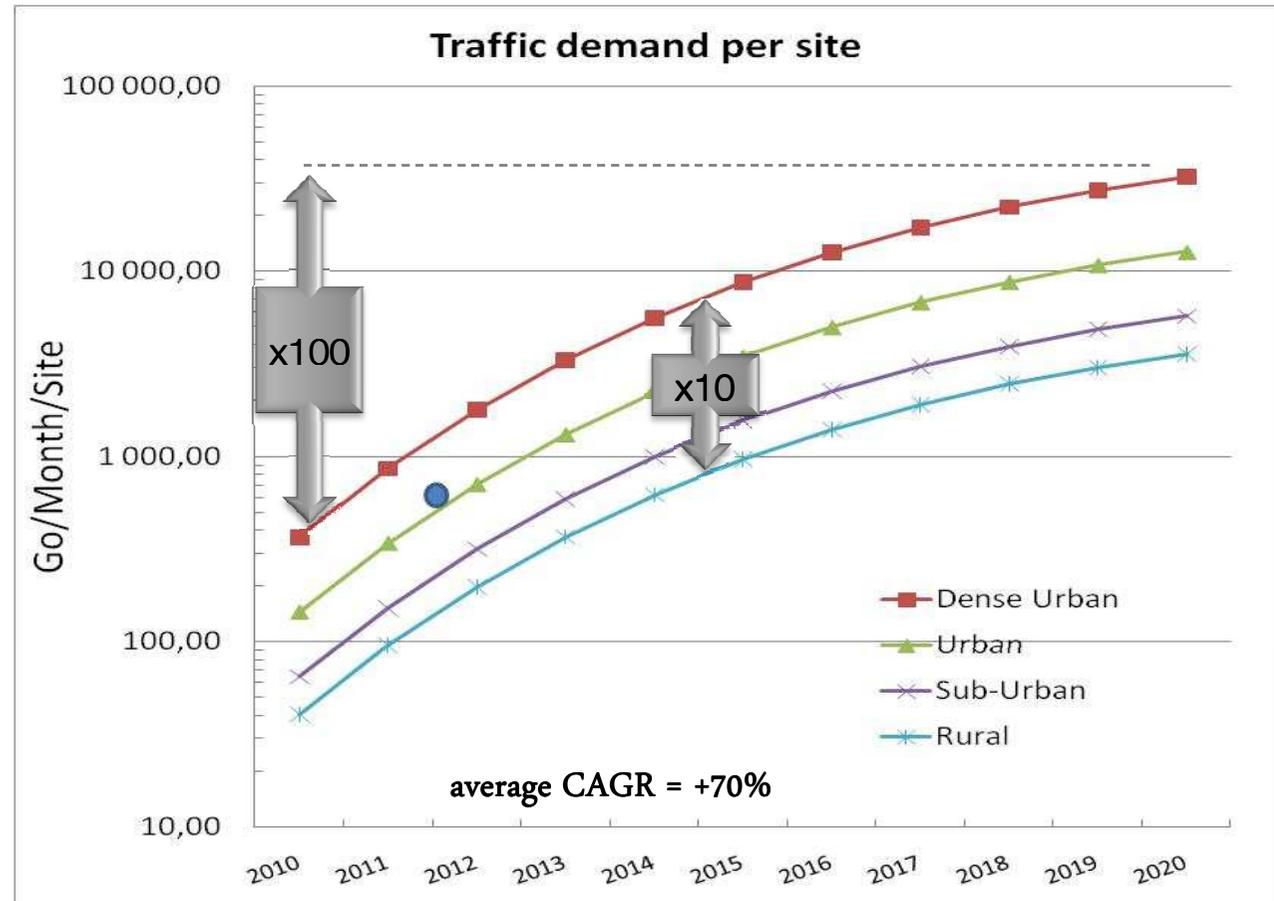
- Each site is loaded according to the traffic demand given in this figure (GreenTouch traffic group)

- the projections gives :

  - x 100 traffic demand/sector between 2010 vs. 2020

  - x 10 for Dense Urban vs Rural

Potential Offload Scenario with traffic growth of x100 by 2020

- Case of Smartphone / Tablet driven market
- Based on usage location: 40% at home, 20% at work and 40% on the move

70% traffic on non macro network solutions

2011 Current traffic

Macro Network (30%)

Broadcast (5%)

Public Places Small Cells (5%)

Private Places - Indoor WiFi / Small Cells (10%)

Outdoor solutions - Community WiFi / Small Cells (10%)

Enterprise WiFi / Small Cells - Operator (15%)

Home Solutions (25%). Mainly WiFi, partly Femto.
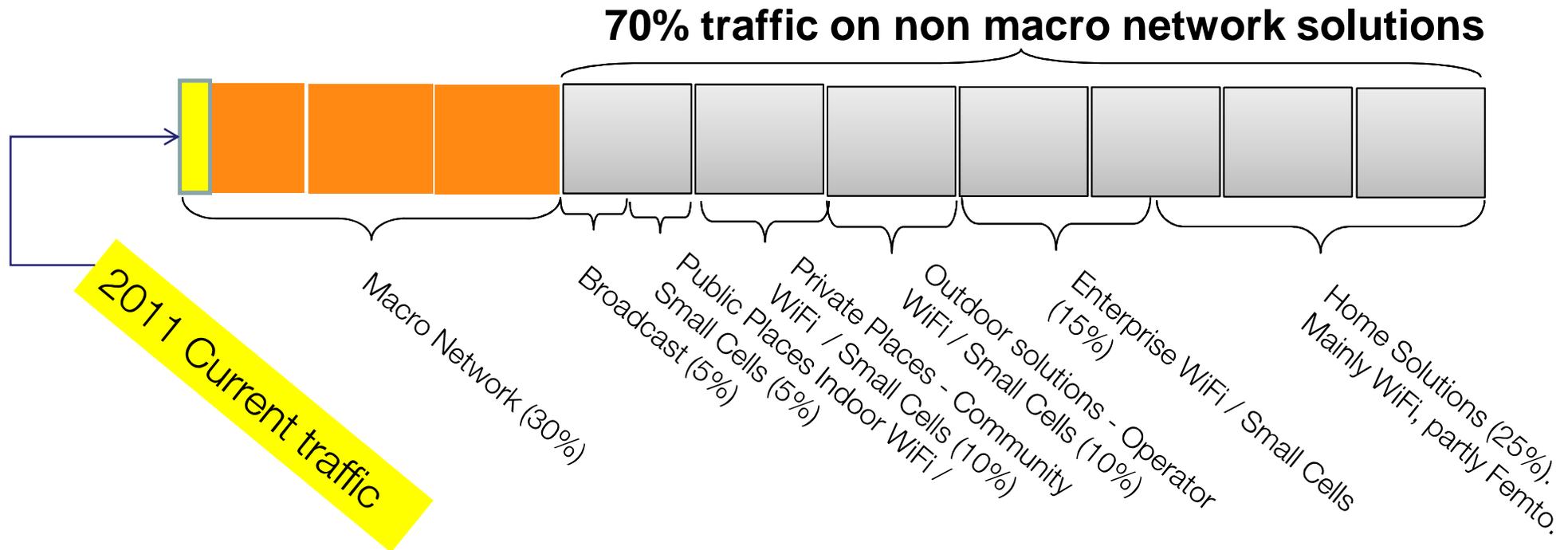
LTE study case – with GreenTouch

- **Need densification**
  - > in Dense from 2017 urban (2-4 picos/sector)
  - > in Urban from 2020 (1-2 picos/sector)

- **energy opex saving estimation (LTE only)**
  - > fast-sleep mode feature from 2013 : 10-15% reduction
  - > HW renewal in 2020 : x3 in EE
  - > off-loading is suitable for optimizing Fast-sleep-mode efficiency

- **More saving if applied to 2G and 3G**

Consumption Evolution

Legend: Dense Urban, Urban, Sub Urban, Rural — GWh/year — 2013 / 2020 — x3
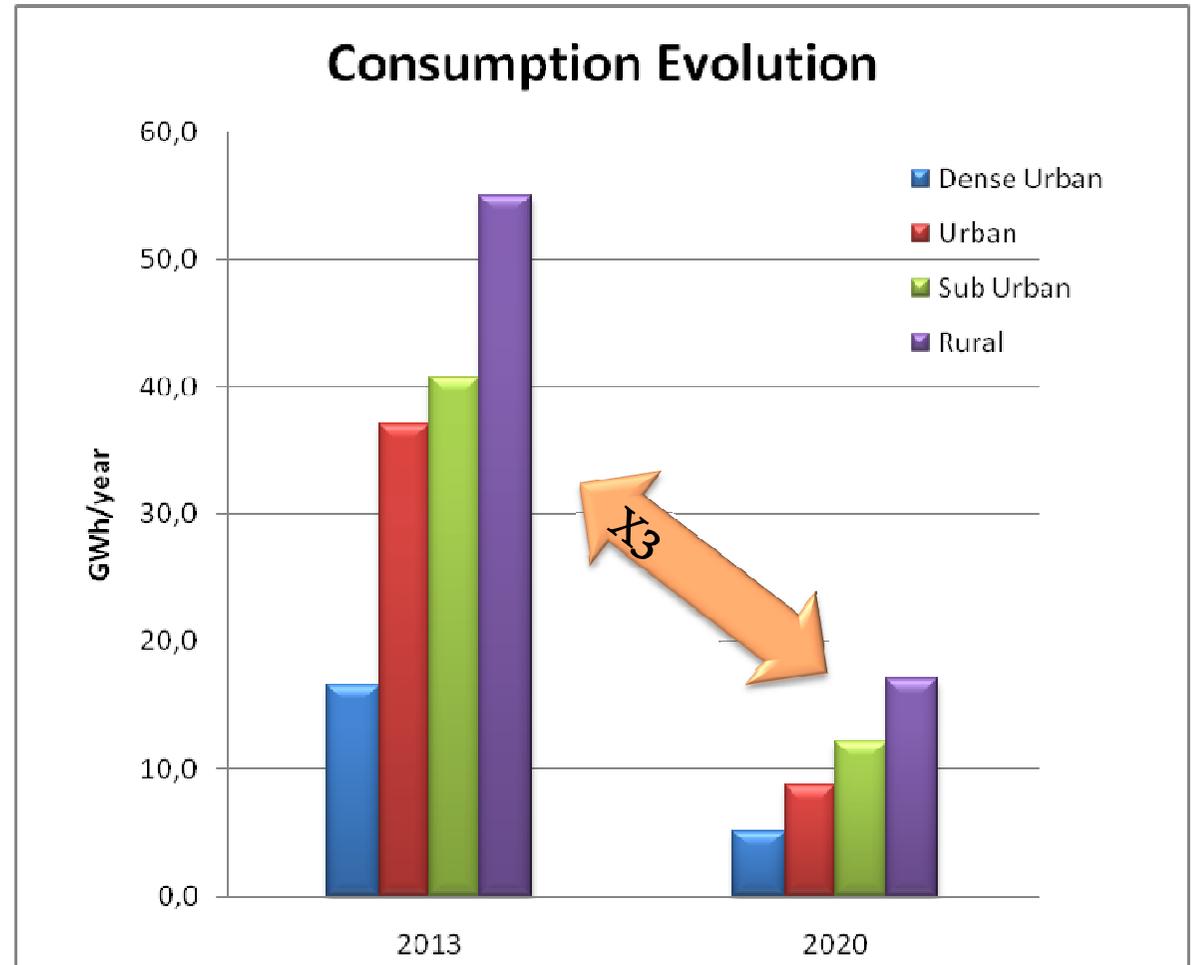
conclusion

- Main advances will come from different levers:
  - > Electronics : move from CMOS 40nm to 20nm
  - > Power amplifiers: signal processing (how to reduce signal distortion) and new materials (GaN).
  - > Convergence: new point of presence that include fixe (MSAN) and mobile (nodes) in the same hardware and the same site
  - – reconfigurable hardware
- push together for an aggressive improvement of energy efficiency and energy consumption of hardware
- need a paradigm shift in hardware (green by design) and software (management)
- standardization for accelerating time-to-market
- EU should take into-account ICT stakeholders that allow other sectors for reducing their environmental footprint

we build too many roads and not enough bridges

I. Newton